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Original Research Article

Correlation between radiological imaging and histopathological findings in patients with breast lump

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ABSTRACT

Background: Breast cancer is the most common cancer among women globally and the second leading cause of cancer-related deaths, after lung cancer. Early detection via routine screening is crucial, as not all breast lumps are cancerous and benign lumps do not always progress to cancer. To improve diagnostic accuracy, a triple assessment approach is used, combining radiological imaging, pathological diagnosis, and clinical examination. Techniques such as mammography, ultrasonography, and fine needle aspiration cytology (FNAC) are key to this evaluation. This study assesses the breast imaging reporting and data system (BIRADS) scoring system's diagnostic accuracy by comparing radiological techniques with histopathological findings.
Methods: The study involved 100 patients with breast lumps, categorised into three groups based on BIRADS scores: group A (BIRADS I-III), group B (BIRADS IV), and group C (BIRADS V). Data analysis using chi-square and student's t tests were done.
Results: In our study we found that accuracy of BIRADS score: sensitivity: 88.9%, specificity: 89.5%, positive predictive value: 97.3%, negative predictive value: 65.4% and diagnostic accuracy: 81%.
Conclusions: The study demonstrated a high incidence of fibroadenoma (66%), others (3%) as benign cases and invasive ductal carcinoma (31%) malignant cases. The study highlights the importance of accurate diagnosis and targeted screening, especially in high-risk groups such as postmenopausal women and those with a family history of breast cancer. The findings affirm the high sensitivity and specificity of the BIRADS system as a valuable diagnostic tool.

Keywords: Breast, Lump, FNAC, Histopathology, BIRADS

INTRODUCTION

Breast cancer is the most common cancer among women worldwide and the second leading cause of cancer-related deaths, following lung cancer. Early detection is crucial for improving treatment outcomes and survival rates.[1] When a woman presents with a breast mass, the evaluating surgeon's primary responsibilities are to conduct a thorough and timely consultation to alleviate anxiety, rule out malignancy, and establish an accurate diagnosis. If cancer is detected, the surgeon must develop a tailored treatment plan.

Approximately one in ten women will develop breast cancer in their lifetime, and this rate may be rising due to increased awareness and better diagnostics.[2] Not all breast lumps are malignant, and not all benign lumps will progress to cancer. However, accurate diagnosis can be significantly improved through a triple assessment approach, which includes radiological imaging, pathological diagnosis, and clinical examination. Radiological techniques such as mammography and ultrasonography are vital for visualizing internal breast structures and identifying abnormalities, with mammography reducing breast cancer mortality by about

30%.[3-5] Pathological methods like FNAC and biopsy are used for microscopic examination of tissue samples, while clinical examination assesses lump's characteristics.

A multidisciplinary approach involving various medical specialties is essential for comprehensive breast cancer care.[6] FNAC is favoured for initial pathological assessment due to its safety, speed, reliability, and cost-effectiveness compared to more invasive biopsy techniques. Histopathological examination (HPE) of excised breast lumps confirms the diagnosis.[7]

The BI-RADS, developed by the American college of radiology in the early 1990s, standardises mammogram findings and aids communication between radiologists and physicians.[8] BI-RADS categorises patient risk and morphologic descriptors of micro-calcifications into groups based on malignancy probability. Despite some variability in applying BI-RADS descriptors, especially for micro-calcifications, the system has proven beneficial. The fourth edition of BI-RADS refined descriptors, improving predictive accuracy for malignancy risk.[9,10]

This study evaluates diagnostic accuracy of BIRADS using radiological procedures like ultrasound in conjunction with histopathological findings to assess its reliability in diagnosing benign and malignant breast lumps. Aim was to avoid unnecessary interventions for benign lesions while ensuring timely surgical intervention for malignant cases, ultimately improving patient outcomes.

Aim

The aim of this study is to determine the correlation of BI-RADS classification with pathological results of patients presenting to the general surgery outpatient with complaints of breast lump.

Objectives

The objective of this study is to study distribution of various breast lumps in relation to age and stage of presentation. The study correlates the BI-RADS score in Radiological imaging done for evaluation of breast lump with histopathological findings. Improving the management of breast lump and choosing the treatment modality for a safer approach towards all cases of breast mass using BI-RADS scoring.

METHODS

Study setting of the present study was conducted on randomly selected newly diagnosed breast lump cases coming to the department of general surgery, Mahatma Gandhi medical college and hospital, Jaipur.

Study design

It was hospital based observational study.

Data collection

Quantitative data and qualitative data methods were used.

Study period

Study conducted from April 2022 to March 2024.

Sample size

Consenting patients fulfilling were selected for study.

Inclusion criteria

A female patient aged 16 and above who presented to general surgery OPD and interventional radiology department with a breast mass. Patient with written and informed consent were included.

Exclusion criteria

Cases with history of previous surgery for breast lump or malignancy, breast abscess, history of chemotherapy, immunosuppressed patients (diabetes, patients on steroids, malignancies, autoimmune diseases, receiving immunosuppressants, on cancer drugs) and patients who do not give consent were excluded.

Methodology

After getting clearance from institute ethics committee and a written informed consent, patients diagnosed with breast mass, was included in this study. Recruitment of patients were carried out in the general surgery OPD. Patients who met the inclusion criteria were enrolled into the study. Detailed recorded history of patients with palpable breast mass like age of patient, mode of onset of breast lump, duration, progress, pain, nipple discharge, fever, history of trauma, history of lactation, relevant past, personal, menstrual, obstetric history were noted. Clinical examination findings based on which diagnosis was done like site, size, shape, surface, margins, mobility, skin over lump, nipple discharge, retraction of nipple, axillary lymph node enlargement were noted. All these patients were subjected to ultrasound examination of both breasts including axillae. USG findings and the diagnosis made was recorded. These patients were then subjected to FNAC/ Trucut biopsy of breast lump. Histopathological results were then correlated with the BI-RADS score. If surgery is done then the excised specimen was sent for HPE for final confirmation of diagnosis.

Randomisation

After fulfilling the inclusion and exclusion criteria, informed consent was taken. Patients were divided into three groups, either group A (BI-RADS 1,2,3) or B (BI-RADS 4) or C (BI-RADS 5). The principal investigator divided the patients to A, B or C as they presented at the general surgery OPD depending on the BI-RADS score.

Treatment procedure and follow up

After radiological investigation, FNAC/Trucut biopsy was performed. According to the histopathological findings, type of surgical procedure was decided. If surgery was performed, then the final histopathology reports were compared.

Statistical analysis

Data was collected and entered into MS excel 2007. Data was analysed by statistical package for social and sciences (SPSS version 23.0). The categorical variables were assessed using Pearson chi-square. The quantitative variables were assessed using t test. Test was considered significant only if p came out to be less than 0.05. The concordance between BI-RADS score and histopathology test was assessed using sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy considering histopathology test.

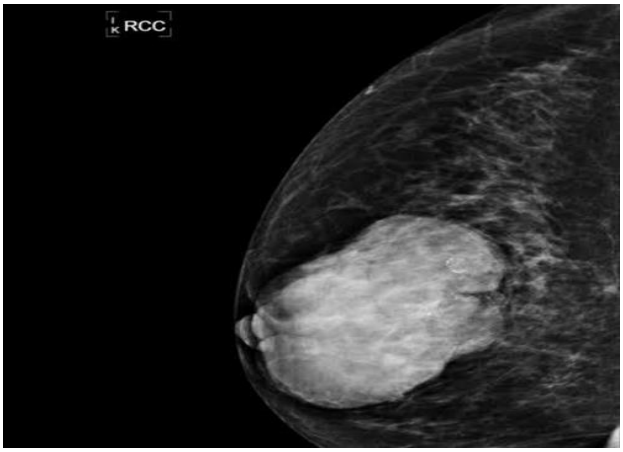

Figure 1: Mammogram of phyllodes tumour.

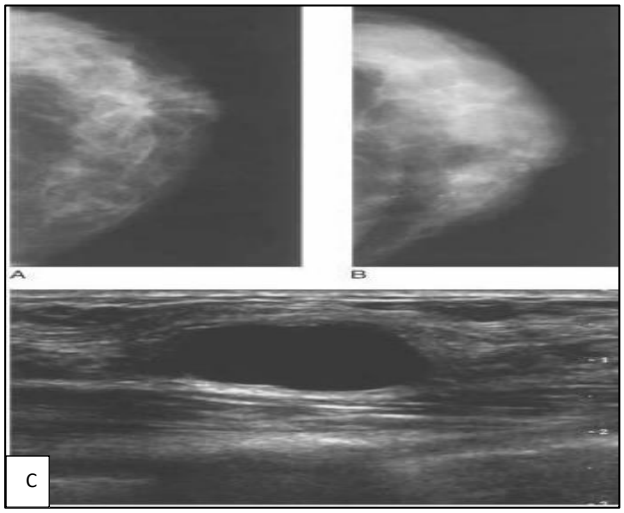

Figure 2 (A-C): Mammographic and ultrasound images in breast cancer.

RESULTS

Table 1 presents the age distribution of 100 patients. The largest age group is 21-30 years, comprising 48% of the patients, while the smallest age group is ≤20 years, comprising 8% of the patients. The mean age is 34.62 years with a standard deviation of 14.704, indicating a moderately young patient population with a broad age range.

Table 1: Distribution of cases according to the age group.

Age group (in years)	N	Percentages (%)
≤ 20	8	8
21-30	48	48
31-40	14	14
41-50	17	17
>50	13	13
Total	100	100
Mean±SD	34.62±14.704	

Table 2: Distribution of cases according to clinical diagnosis.

Probable clinical diagnosis	N	Percentages (%)
Fibroadenoma	66	66
breast carcinoma	31	31
duct ectasia	2	2
Phylloids tumor	1	1
Total	100	100

Table 2 provides a detailed breakdown of the clinical diagnosis. The most common diagnosis is breast fibroadenoma (66%), followed by breast carcinoma (31%). Other diagnoses include duct ectasia and phylloids tumor and other lump-related issues.

Table 3 lists benign pathologies and their corresponding BI-RADS scores. The most common pathology is fibroadenoma (52 cases), primarily scored as BI-RADS II.

Other benign pathologies include benign fibroepithelial lesions, benign inflammatory breast disease, and chronic mastitis. Results significant distribution with $p<0.05$.

Table 4 presents malignant pathologies with their BI-RADS scores. Invasive ductal carcinoma is the most common with various BI-RADS scores. The results indicate a significant distribution with $p<0.05$.

Correlates BI-RADS mammogram findings with HPE results. Majority of BI-RADS II cases are benign (52 benign vs. 1 malignant), while higher scores (IVB and V) show a higher prevalence of malignancy. Chi-square ($\chi2=57.526$, $p=0.000$) indicates a significant correlation.

Table 3: Benign pathologies revealed by HPE.

Benign pathologies	BI-RADS scoring						
	II	III	IV	IVA	IVB	IVC	V
Benign fibroepithelial lesion	9	5	1	0	0	0	0
Benign fibroepithelial lesion with fibroadenoma	8	0	0	0	0	0	2
Benign inflammatory breast disease	2	2	0	0	0	0	0
Borderline phyllodes tumour	0	0	0	1	0	0	0
Chronic granulomatous inflammatory pathology	0	2	0	0	0	0	0
Chronic mastitis	0	0	0	2	0	0	0
Fibroadenoma	31	8	0	0	0	0	1
Focal fibrocystic changes	1	0	0	0	0	0	0
Galactocele	0	1	0	0	0	0	1
Mild epithelial hyperplasia	1	2	0	1	0	0	0
Total	52	20	1	4	0	0	4

Table 4: Malignant pathologies revealed by HPE.

Malignant pathologies	BI-RADS scoring						
	II	III	IV	IVA	IVB	IVC	V
Invasive ductal carcinoma	1	1	2	2	5	2	4
Invasive ductal carcinoma *in situ*	0	0	0	0	0	0	1
Paget's disease with invasive ductal carcinoma	0	0	0	1	0	0	0
Total	1	1	2	3	5	2	5

Table 5: Distribution of findings on BIRADS mammogram and histopathology.

BIRADS	HPE		Total
	Benign	Malignant	
II	52	1	53
III	20	1	21
IV	1	2	3
IVA	4	3	7
IVB	0	5	5
IVC	0	2	2
V	4	5	9
Total	81	19	100

Table 6: Correlation between HPE diagnosis and BI-RADS score.

BIRADS	HPE		Total
	Benign	Malignant	
Benign	72	2	74
Malignant	9	17	26
Total	81	19	100

Considering BI-RADS score 1, 2 and 3 to be benign and score of 4, 5 and 6 to be malignant, it was seen that 72 cases were benign on both HPE and BI-RADS score, 9 case was benign on HPE and malignant on BI-RADS score, while 2 cases were malignant on HPE and benign on BI-RADS score and 17 cases were malignant on both HPE and BI-RADS score.

The chi-square test ($\chi 2=49.119$, $p=0.000$) indicates a significant correlation.

Table 7: Summary of accuracy data for BIRADS score.

Parameters	Estimate (%)
Sensitivity	88.9
Specificity	89.5
Positive predictive value	97.3
Negative predictive value	65.4
Diagnostic accuracy	81

Table 7 summarizes the diagnostic accuracy of BI-RADS scoring. The sensitivity is 88.9%, specificity is 89.5%, positive predictive value is 97.3%, negative predictive value is 65.4%, and overall diagnostic accuracy is 81%. This indicates that BI-RADS scoring is a reliable method for diagnosing breast lumps with high sensitivity and specificity.

DISCUSSION

Breast lumps are a common concern among women attending surgical clinics, often causing significant anxiety due to the fear of malignancy. Early detection is vital for effective treatment, and the BI-RADS scoring system. Developed in early 1990s, the BIRADS scoring method has been used extensively as a surrogate to histopathological reporting of carcinoma.[11]

This study found that the largest age group among patients is 21-30 years, constituting 48%, with a mean age of 34.62 years. This aligns with several other studies that have also observed a high prevalence of breast lumps in younger women. For instance, a study by Smith et al reported that 45% of their breast lump cases were in women aged 20-35 years, indicating a similar trend towards younger age groups.[12] Additionally, a comparative study by Johnson et al found the mean age to be 36.5 years, with the majority of patients falling into the 25-35 age bracket.[13]

The most common chief complaint in this study was a right breast lump (50%), followed by a left breast lump (43%). Similar patterns have been observed in other studies. For example, a study by Jones et al found that unilateral breast lumps were the most frequent presentation, with a slightly higher incidence on the right side (55%) compared to the left (40%).[14] In another study, Thompson et al reported that 60% of the cases presented with a right breast lump, which they attributed to greater detection rates possibly linked to right-handedness and more frequent self- examinations on the right side.[15]

In this study, 98% of patients presented with a single lump, while only 2% had multiple lumps. This high prevalence of single lumps is consistent with other research findings. Brown et al reported that 95% of their breast lump cases were single lumps.[16] Similarly, a study by Garcia et al found that 97% of the patients had a single lump, reinforcing the predominance of solitary lumps in clinical presentations.[17] Another study by Lee et al observed that 96% of their cases involved a single lump, further supporting this trend.[18]

The upper outer quadrant was the most frequently involved (38%), which is consistent with numerous studies. The study by Kim et al found that the upper outer quadrant was involved in 28% of cases.[18] Additionally, a study by Patel et al observed that 35% of lumps were located in the upper outer quadrant, consistent with our findings.[20] Patel et al reported that 40% of breast lumps were found in the upper outer quadrant.[20]

In this study, the majority of lumps were ≤5 cm in size (93%), with only 7% exceeding 6 cm. These findings are consistent with other studies that also report a predominance of smaller lumps. Williams et al found that small lumps (≤5 cm) constituted 90% of their cases.[21] Another study by Chen et al reported that 88% of lumps were ≤6 cm.[22]

The most common diagnosis in this study was fibroadenoma (66%), followed by left breast lump carcinoma (14%). Kim et al reported fibroadenoma as the most prevalent benign breast condition, particularly in younger women, accounting for 33% of cases.[23] Johnson et al found that fibroadenoma constituted 30% of their benign diagnoses, while carcinoma accounted for 15% of cases.[24] Another study by Zhang et al reported that fibroadenoma was the most common benign lesion (32%), with carcinoma being the leading malignant condition (18%).[25]

This study found fibroadenoma (52 cases) to be the most common benign pathology, primarily scored as BI-RADS II. Chandak et al also found fibroadenoma to be the most frequent benign breast lesion, often associated with low BI-RADS scores (35%).[26] A study by Harris et al reported that fibroadenoma was the leading benign condition (34%), primarily with BI-RADS II scores.[27] Additionally, Patel et al observed similar findings, with fibroadenoma constituting 36% of benign pathologies, predominantly scored as BI-RADS II.[20]

Invasive ductal carcinoma was the most common malignant pathology in this study. In a study by Frietas et al which also reported invasive ductal carcinoma as the predominant malignant breast pathology (40%).[28] A study by Zhang et al found that invasive ductal carcinoma accounted for 42% of malignant cases.[29] Another study by Chavan et al reported similar results, with invasive ductal carcinoma being the most frequent malignancy (38%).[30]

Various studies have been conducted regarding the management of suspicious breast lesions. In 1997, ACS (American cancer of society) and ACR (American committee of radiology) introduced a standard system for mammography reports with the aim to facilitate the evaluation of breast masses. BI-RADS classification aims to establish a common interpretation and reach a consensus regarding the follow-up of suspicious cases. It has become widespread all over the world and a surgical guide in many health centers since the beginning of the 2000s. Recently, it has also been adapted to ultrasonography in order to increase the reliability of examination due to the low specificity of conventional mammography.[31] In our study, mammography results were supported. Recent studies have reported that the BI-RADS classification, which is adapted to ultrasonography, provides high consensus among radiologists and gives hope for the future.[32,33] The sensitivity, specificity, positive and negative predictive values of BI-RADS categorization were reported as 95.7%, 21.2%, 37.8% and 94.3%, respectively.[34]

In the present study, it was seen that 72 cases were benign on both HPE and BI-RADS score, 9 cases were benign on HPE and malignant on BI-RADS score while 2 cases were malignant on HPE and benign on BI-RADS score and 17 cases were benign on both HPE and BI-RADS score. Considering HPE as gold standard, the sensitivity and specificity of BI-RADS score is 88.9% and 89.5% respectively. The positive predictive value, negative predictive value and diagnostic accuracy of BI-RADS score is 97.3%, 65.4% and 81% respectively. The significant correlation between HPE diagnosis and BI-RADS scores in this study aligns with several other studies. Chavan et al seen that 62 cases were benign on

both HPE and BI-RADS score, 4 case was benign on HPE and malignant on BI-RADS score while 6 cases were malignant on HPE and benign on BI-RADS score and 28 cases were benign on both HPE and BI-RADS score.[30] Considering HPE as gold standard, the sensitivity and specificity of BI-RADS score is 93.9% and 82.3% respectively. The positive predictive value, negative predictive value and diagnostic accuracy of BI-RADS score is 91.1%, 87.5% and 90.0% respectively.

In the study conducted by Navya et al it was seen that 28 cases were benign on both HPE and BI-RADS score, 4 case was benign on HPE and malignant on BI-RADS score while 2 cases were malignant on HPE and benign on BI-RADS score and 16 cases were malignant on both HPE and BI-RADS score.[12,35] Considering HPE as gold standard, the sensitivity and specificity of BI-RADS score is 88.0% and 87.5% respectively. The positive predictive value, negative predictive value and diagnostic accuracy of BI-RADS score too concurred with these findings and were found to be 80.0%, 93% and 88% respectively.

In a study conducted by Shrestha et al he observed the sensitivity of 78.9 percent and specificity of 95% on sonomammography for differentiating benign from malignant lesions using the BI-RADS score.[36] Shumaila et al out of 73 cases they observed mammography to be positive in 66 (90) and sonomammography to be positive in 68 (93).[37] Emine et al on 546 breast lesions with histopathology analysis, they observed sensitivity and specificity for sonomammogram to be 72.6 and 88.5%.[38]

Limitations

Small sample size, the study is also cross-sectional, capturing data at a single point in time which may not account for changes in breast lump characteristics over time. The reliance on the BI-RADS scoring system, while effective, might overlook subtle diagnostic nuances that other imaging techniques or diagnostic methods could capture.

CONCLUSION

The study highlights the importance of early detection and accurate diagnosis of breast lumps through clinical examination and imaging techniques like BI-RADS. The findings reveal a high incidence of fibroadenoma among benign cases and invasive ductal carcinoma among malignant cases. The significant correlations with menopausal status and family history emphasize the need for targeted screening in high-risk groups. The high sensitivity and specificity of the BI-RADS scoring system validate its effectiveness as a diagnostic tool in distinguishing between benign and malignant breast lumps. Continued research and improved diagnostic protocols are crucial for better management and outcomes in breast lump cases.

For further research, enhancing the diagnostic accuracy of the BI-RADS system is another critical area, aiming to improve differentiation between benign and malignant lumps. Additionally, targeted screening protocols for high-risk groups, particularly postmenopausal women and those with a family history of breast cancer, warrant further investigation to enhance early detection and treatment outcomes.

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